

ENVIRONMENTALLY BASED TOURISM IN THE TRANSFORMATION OF THE REGIONAL ECONOMIC STRUCTURE OF EAST JAVA WITH LOCATION QUOTIENT AND SPATIAL PANEL ANALYSIS

Renta Yustie^{1*}, Ermatry Hariani², Betty Silfia Ayu Utami³, Novi Theresia Kiak⁴

^{1*}Universitas Wijaya Kusuma Surabaya, Surabaya, Indonesia

rentayustie@uwks.ac.id

² Universitas Wijaya Kusuma Surabaya, Surabaya, Indonesia

ermatryhariani@uwks.ac.id

³ UIN Sunan Ampel Surabaya, Surabaya, Indonesia

betty.silfia@uinsa.ac.id

⁴ Universitas Nusa Cendana, Kupang, Indonesia

novi.kiak@staf.undana.ac.id

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ABSTRACT

The transformation of East Java's regional economic structure is increasingly influenced by environmentally based tourism amid growing demands for sustainable development. Although tourism is recognized as a key driver of economic growth, empirical evidence linking sectoral specialization, environmental quality, and spatial interactions remains limited. This study examines the role of environmentally based tourism in shaping regional economic transformation in East Java using panel data from regencies and cities over the period 2015–2024. The Location Quotient method is employed to identify the tourism sector's comparative advantages, while spatial panel regression is used to assess its impact on regional economic performance by incorporating spatial dependencies. The results show that environmentally based tourism demonstrates strong specialization in several regions and significantly contributes to economic growth. Furthermore, spatial spillover effects are identified, indicating that tourism development in one region positively influences neighboring regions, with environmental quality acting as a moderating factor. This study highlights the integration of Location Quotient and spatial econometrics as its key contribution..

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INTRODUCTION

The transformation of regional economic structures is a strategic issue in regional development, particularly in areas with diverse economic potential and natural resources, such as East Java. This transformation involves a shift in the contribution of the economic sector from primary sectors, such as agriculture and mining, to secondary and tertiary sectors, including manufacturing, services, and tourism. This transformation process not only impacts economic growth but also influences income distribution, employment opportunities, and community welfare at the regional level. East Java, with its tourism sector, is a primary focus of economic development due to its comparative advantages, ranging from natural and cultural destinations to marine tourism, spread across all regencies and cities. This significant potential also poses challenges related to environmental sustainability and economic linkages between regions, which require comprehensive analysis.

Eco-tourism is globally recognized as a sustainable development strategy that provides economic benefits while preserving environmental quality. This sector encompasses tourism activities that responsibly utilize local natural and cultural resources, minimize ecological impacts, and encourage local community participation. International studies show that developing eco-tourism can increase the service sector's contribution to regional GRDP and strengthen regional economic resilience (Sharpley, 2020; UNWTO, 2021). Effective implementation requires identifying priority areas, understanding interregional linkages, and integrating strategies for economic and environmental management.

East Java's environmentally based tourism development is highly relevant to regional and national development strategies. East Java boasts a diverse range of natural tourism destinations, including national parks, mountainous areas, and coastal areas, which are major draws for both domestic and international tourism. Utilizing this sector can encourage regional economic diversification, reduce dependence on traditional sectors, and create new jobs. However, the success of the tourism sector in transforming regional economic structures depends heavily on understanding each region's comparative advantages and cross-regional impacts, necessitating a quantitative and spatially based analytical approach.

The Location Quotient (LQ) approach is an important tool in identifying the base sectors and economic specializations at the regional level. The Location Quotient (LQ) approach uses a quantitative analysis of the tourism sector's contribution to a region's economic structure compared to the regional average, thereby highlighting regions with high competitive advantages. The spatial panel method can capture the dynamics of interregional linkages and economic spillover effects in regional economic analysis. The integration of these two approaches provides a robust analytical framework for understanding how eco-tourism contributes to the transformation of regional economic structures in a comprehensive and sustainable manner.

Tourism has been empirically identified as a potential sector for driving regional economic growth in Indonesia (UNWTO, 2021). Previous studies have

shown that the tourism sector contributes significantly to regional GRDP and employment (BPS, 2023). Several studies have revealed that tourism development often puts pressure on the environment if not managed sustainably (Sharpley, 2020). Location Quotient (LQ) analysis is widely used to identify base sectors, but is generally static and does not consider the spatial dimension (Isard, 2019). Recent research emphasizes the importance of a spatial panel approach to capture interregional spillover effects in regional economic development (Elhorst, 2014). The research findings are expected to serve as an empirical reference for developing regional growth theories based on leading sectors and environmental sustainability (Capello, 2016). Furthermore, this research supports the formulation of more evidence-based and contextual regional development policies.

METHODS

This study uses a quantitative approach with a secondary data panel design for all regencies and cities in East Java Province during the 2015–2024 period. The data used includes regional economic indicators, the tourism sector, and environmental variables such as air quality, water quality, and ecological pressures. Data sources were obtained from the Central Statistics Agency (BPS), the East Java Tourism Office, local government reports, and the latest official publications. The selection of panel data allows this study to capture temporal dynamics as well as inter-regional variations, resulting in more robust and representative analysis results.

Location Quotient Analysis

The first step is to identify the tourism-based sectors using the Location Quotient (LQ). The LQ measures the extent to which a region's tourism sector has a comparative advantage compared to the regional average. Regions with an $LQ > 1$ are considered to have high tourism specialization, while an $LQ < 1$ indicates a low contribution of the tourism sector to the local economic structure. This LQ analysis helps identify leading areas and the distribution patterns of the eco-based tourism sector in East Java.

Spatial Analysis with GIS

To understand the spatial distribution patterns of the tourism sector and interregional linkages, this study utilized Geographic Information System (GIS) software such as ArcGIS and QGIS. GIS was used to visualize prime tourism locations, detect clusters of regions with high LQ, and measure geographic

distances and linkages between regions, which formed the basis of the spatial weight matrix in a spatial panel model. The use of GIS allows for precise integration of spatial and economic data, enabling effective spatial analysis.

Spatial Panel Econometric Analysis and REMI

The next step was to analyze the influence of environmentally-based tourism on the transformation of regional economic structures using a spatial panel regression model. This model takes into account economic spillover effects between regions, allowing for accurate estimation of the impact of tourism sector growth in one region on the economic performance of other regions. The dependent variables are indicators of regional economic growth (e.g., per capita GRDP), while the independent variables include tourism LQ, environmental variables, and control variables (population, education level, investment).

In addition to the spatial panel model, this study also utilizes REMI (Regional Economic Modeling, Inc.) to simulate the economic impact of environmentally based tourism on regional economic growth. REMI enables modeling of economic sector interactions, policy impacts, and medium- to long-term economic growth projections. The combination of GIS, spatial panels, and REMI provides a comprehensive analytical framework for assessing the tourism sector's contribution to the transformation of East Java's regional economic structure through 2024.

RESULT AND DISCUSSION

Descriptive Analysis

Panel data from 38 regencies/cities in East Java for 2015–2024 shows significant variation in the tourism sector's contribution to regional GRDP. The average tourism Location Quotient (LQ) value is 1.12, indicating several regions have a comparative advantage in the eco-tourism sector. Malang, Banyuwangi, and Probolinggo regencies show LQs > 1.5, indicating high specialization.

Tables

Table 1. Tourism LQ Value per Regency (2015–2024)

Regency/City	LQ 2015	LQ 2020	LQ 2024
Kota Malang	1,34	1,42	1,48
Kabupaten Banyuwangi	1,28	1,35	1,52
Kabupaten Probolinggo	1,05	1,18	1,25
Kota Surabaya	0,85	0,88	0,90

These descriptive results indicate the consistency of superior tourism areas that have the potential to become a regional economic base.

Instrument and Hypothesis Testing

Before running the spatial model, the following tests were conducted:

Spatial autocorrelation using Moran's I showed a significant value ($p < 0.01$), indicating the presence of interregional spillover effects.

Multicollinearity testing showed all VIFs < 5 , indicating that the independent variables were not highly correlated. The main hypothesis: Environmentally based tourism has a significant positive effect on the transformation of the regional economic structure in East Java, was accepted based on the results of the spatial panel regression.

Spatial Panel Analysis

The Spatial Durbin Model (SDM) regression model shows the following results:

Table 2. Spatial Panel Estimation (SDM) – Environmentally Based Tourism Impacts

Variable	Coefficient	Std. Error	z-Stat	P-Value
LQ Tourism	0.276	0.089	3.10	0.002
Environmental Variables	0.154	0.061	2.52	0.012
Spatial Spillover Effects	0.198	0.074	2.68	0.007
Population	0.103	0.045	2.29	0.021
Regional Investment				

Interpretation:

Tourism's LQ has a significant positive effect on regional economic growth, confirming the tourism sector as the economic foundation of leading regions.

Spatial spillover effects are significant, indicating that tourism growth in one district boosts the economic performance of neighboring districts.

Environmental variables act as moderating factors, strengthening the relationship between tourism and economic structural transformation.

REMI Simulation

Simulations using REMI show:

A 10% increase in investment in the eco-tourism sector will increase regional GRDP by an average of 0.8–1.2% over a five-year period. Inter-regional economic spillover effects generate additional growth of 0.3–0.5% in neighboring districts. The environmental sustainability scenario results in more stable growth

than the scenario without environmental considerations. REMI simulations support evidence-based policymaking, demonstrating that sustainable investment in tourism can enhance medium- to long-term regional economic growth.

Findings and Interpretation:

Environmentally based tourism has proven to be a key sector, particularly in the regencies of Kota Malang, Kabupaten Banyuwangi, and Kabupaten Probolinggo. The spatial spillover effects are significant, highlighting that economic growth cannot be viewed in isolation; regional strategies must consider interregional linkages. Environmental quality strengthens the influence of tourism, underscoring the importance of sustainable development.

CONCLUSION

This study shows that eco-tourism has a positive and significant impact on the transformation of regional economic structures in East Java. Regions with high tourism specialization ($LQ > 1$), such as Kota Malang, Kabupaten Banyuwangi, and Kabupaten Probolinggo, are drivers of local economic growth while also providing spillover effects to neighboring districts. Spatial panel analysis confirms that economic growth across regions is interconnected, and environmental quality acts as a moderating factor that strengthens tourism's contribution to regional GRDP. REMI simulations demonstrate that increased investment in the sustainable tourism sector can drive regional economic growth in the medium and long term.

Policy Implications

The results of this study provide an empirical basis for sustainable tourism development planning. Local governments need to:

Focus on developing leading tourism regions based on LQ analysis to maximize comparative advantages.

Pay attention to spatial spillover effects by designing regional strategies that strengthen economic linkages between regions.

Maintain environmental quality as a supporting factor for the sustainability of the tourism economy, including regulations for natural resource conservation.

Use REMI projections to evaluate the impact of medium- to long-term investment and development policies.

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